

# Contraindications and Cautions of Foam Rolling – A Delphi Process to Reach Consensus: Study Protocol

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## Study Protocol

**Keywords:** Contraindication, Delphi Technique, Soft Tissue, Foam Rolling

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# Abstract

**Background:** Foam rolling is a type of self massage using tools such as foam rollers or roller massagers. As no consensus on contraindications and cautions of foam rolling exists to date, current suggestions in the literature are drawn from the field of therapeutic massage. A methodological approach to help closing the gap in the current research landscape is to obtain a reliable opinion consensus of expert groups. The goal of the study is to elaborate experts' recommendations on the contraindications and cautions for foam rolling techniques by the means of a Delphi process.

**Methods:** The present study includes a preparatory phase as well as three rounds of the actual Delphi process. Academic experts, defined as having (co-)authored at least one scientific paper on foam rolling, are identified via literature search and invited to participate. Consensus on contraindications and cautions of foam rolling will be targeted with a 70 percent agreement after the third round of the Delphi process. Anonymity between participants as well as an iterative approach with controlled feedback constitute key features of the method. Exemplary cases may be reported after round three of the Delphi process in an anonymous manner to supplement the aggregated data.

**Discussion:** Measures to improve panelist recruitment and retention, such as person-to-person cascade approaches and the use of publicly-available information to identify experts are considered to be crucial for the success of the study. Benefits and risks of carrying out the study via online questionnaires need to be considered when interpreting the results. Findings from this Delphi process will provide an overview of the risks related to foam rolling and assist in selecting the scope for future studies.

## Background

Foam rolling is a type of self-massage using soft or rigid foam rolls (1–4). Despite its broad application and popularity in medicine and sports, a gap of knowledge exists regarding the contraindications and cautions, when aiming to integrate foam rolling as a therapeutic or training tool into practice (5). In fact, while a growing number of peer-reviewed studies has been published on potential effects and mechanisms of foam rolling (4, 6–9) less is known regarding contraindications and cautions (10, 11). Table 1 shows a recent PubMed literature search that underlines this lack of research. To address the lack of research in the future, more controlled randomized trials are hence clearly needed (12).

Table 1

*PubMed literature search on contraindications and cautions of foam rolling. The search was limited to human subjects and performed on November 02, 2020.*

<b>Search number</b>	<b>Search terms</b>	<b>Search results</b>
# 1	“foam roll”, “foam rolling”, or “foam roller” <i>combined by Boolean logic (“OR”)</i>	146
#2	“contraindication*”, “caution*”, “precaution*”, “red flag*”, or “yellow flag*” <i>combined by Boolean logic (“OR”)</i>	75.613
#1 AND #2	<i>combined by Boolean logic (“AND”)</i>	1

Guidelines advise clinicians to evaluate serious underlying pathology by checking for alarm signals during physical examination and assessment of the patient’s medical history (13). Such alarm signals can be labelled as contraindications or red flags and cautions or yellow flags. We will use the terms contraindication and red flag interchangeably. The same applies to cautions and yellow flags. In this study, we define these terms as follows: Relating to foam rolling, a contraindication/red flag can be defined as a condition or factor that makes foam rolling inadvisable. Contraindications / red flags may be absolute (life threatening) or relative (higher risk of complications in which benefits may outweigh risks).

A caution/yellow flag is a condition in a recipient that may increase the risk for a serious short or long term adverse reaction. Furthermore, a “yellow flag is a cautionary or warning symptom that warrants consideration of a need for screening (14). For both, the contraindications/red flags as well as the cautions/yellow flags of foam rolling, the context such as the person’s age, gender, medical history etc. needs to be considered.

As indicated in Table 1, a topical literature research produced only one paper that comments on the clinical standards and contraindications/cautions within the broader context of foam rolling (10). Cheatham and Stull draw from the therapeutic massage literature (12, 15–20) to produce an initial list of potential contraindications and cautions as empirical evidence is scarce. While said paper is commenting on the contraindications and cautions of roller massage practices, the list of contraindications and cautions can serve as a valuable starting point for more focused investigations.

Table 2  
Roller massage contraindications and cautions (following Cheatham and Stull; (10))

Cautions	Contraindications
<ul style="list-style-type: none"> <li>• Hypertension</li> <li>• Osteopenia</li> <li>• Pregnancy</li> <li>• Diabetes</li> <li>• Varicose Veins</li> <li>• Bony prominences / regions</li> <li>• Abnormal sensations (e.g. numbness)</li> <li>• Sensitivity to pressure</li> <li>• Recent injury or surgery</li> <li>• Inability to position body or perform foam rolling</li> <li>• Young children, older individuals</li> <li>• Scoliosis or spinal deformity</li> <li>• Medications that may alter a person's sensation</li> </ul>	<ul style="list-style-type: none"> <li>• Skin rash, open wounds, blisters, local tissue inflammation</li> <li>• Osteoporosis</li> <li>• Bone fracture or Myositis ossificans</li> <li>• Acute or severe cardiac, liver or kidney disease</li> <li>• Neurologic conditions resulting in loss or altered sensation (e.g. multiple Sclerosis)</li> <li>• Systemic conditions (e.g. Diabetes)</li> <li>• Connective tissue disorders (e.g. Marfan syndrome)</li> <li>• Medications that thin blood or alter sensations</li> <li>• Chronic pain conditions (e.g. Rheumatoid Arthritis)</li> <li>• Pregnancy (consult MD)</li> <li>• Extreme discomfort felt by patient</li> </ul>
	<ul style="list-style-type: none"> <li>• Deep Vein Thrombosis or Osteomyelitis</li> <li>• Cancer or malignancy</li> <li>• Hypertension (uncontrolled)</li> <li>• Acute infection (viral or bacterial), fever, or contagious condition</li> <li>• Bleeding disorders (e.g. hemophilia)</li> <li>• Recent surgery or injury</li> <li>• Peripheral vascular insufficiency or disease</li> <li>• Direct pressure over surgical site or hardware</li> <li>• Direct pressure over face, eyes, arteries, veins (e.g. varicose veins), or nerves</li> <li>• Direct pressure over bony prominences or regions (e.g. lumbar vertebrae)</li> <li>• Severe scoliosis or spinal deformity</li> </ul>

Besides the collection of clinical data as the gold standard model, obtaining a reliable opinion consensus of experts represents another way of gaining insight into potential contraindications and cautions.

The Delphi method is a standardized technique to interactively discuss, form and pool the opinions of several individuals (21). The optimal methodological approach defines criteria for reaching consensus a priori instead of assuming it to be an automatic outcome at the end of a Delphi process (22). According to Diamond and colleagues' systematic review, the most common definitions for consensus are "percent agreement" (example: >70% with the same rating) and "proportion within a range" (example: 80% scoring 5+ on a six-point scale).

In view of the scarcity of papers targeting contraindications and cautions in foam rolling, our study aimed to provide initial data on expert opinions using the Delphi method. Delphi processes have been widely

used across numerous disciplines to seek expert opinion in an iterative structured manner. Throughout the process, anonymity between participants as well as controlled feedback constitute key features of the method (22).

Additional purposes are to present anonymized exemplary cases of adverse events caused by foam rolling.

## Methods

### Ethics and general approach

The present study was approved by the local Ethics committee of Diploma University of Applied Sciences, Bad Sooden-Allendorf, Germany. All participants will provide informed consent. The Delphi process of the present study includes a preparatory phase as well as three rounds of the actual Delphi process (see Fig. 1). The surveys of each round will be delivered using an electronic questionnaire (SurveyMonkey Europe UC, Dublin, Ireland).

### Participants

Experts from the academic realm are invited to participate in the study. Experts' participation will be recognized as we will publish a listing of the panel membership names, granted the participant wishes to be included. Throughout the study, anonymity between participants will be ensured. We strive for 30 to 40 participants for the present study. We will contact potential experts via email, online contact forms as well as social networks such as LinkedIn™ and ResearchGate. As we expect the response rates to this mode of communication to be rather low, we will reach out to about 300 potential panel members initially to reach our sample size goal.

Diamond and colleagues (2014) name the reproducibility of criteria for selection of study participants as a quality indicator for Delphi studies. To ensure such high quality, we outline our methodological approach to identify academic experts as follows: Inclusion criterion for being considered as an academic expert is publication of at least one peer reviewed paper on the topic of foam rolling.

To identify potential academic experts, we made use of publicly-available bibliographic information from our initial PubMed search (see Table 1). All 146 sources found in the PubMed search were evaluated through a title/abstract screening. Furthermore, we reviewed the included articles of relevant reviews/meta-analyses (1–4) and added some references through hand search, leading to a total number 119 eligible sources/articles. Figure 2 gives an overview of the selection process for relevant publications.

Subsequently, we searched for all authors (including co-authors) of the 119 records, which resulted in 396 names. We then searched the internet for contact data of the said 396 authors. Figure 3 shows an overview of the search results. Appendix 1 includes the full overview of our search results.

Potential experts will be contacted with a description of the study goal and process and will be invited to take part in the Delphi process, having in mind that participation through all three rounds will be required.

## **Data Collection: Delphi Process**

### **Preparatory phase**

For survey development, a team of five to ten facilitators organizes the conduct of the Delphi process and refines the research question. This group also performs a literature research in order to obtain an initial evaluation of the question posed – a list of potential contraindications and cautions for foam rolling.

In a second step, the facilitators identify experts to take part in Delphi rounds 1 to 3. Said experts are contacted via e-mail and informed that involvement in the study requires participation in all three rounds of the Delphi process.

### **Delphi process round 1**

In Delphi process round 1, the initial list of contraindications and cautions obtained from the literature is presented to the experts. Each contraindication/caution item is presented with a short description/rationale. Participants will be asked to rate whether they agree that the respective line item is to be considered as contraindication/caution on a 6-point Likert scale. An example of the answer options is presented in Fig. 4.

Participants will be asked to give a short explanation of their rating.

In addition, further possible contraindications and cautions are collected in an open question format: participants can name a contraindication/caution item as well as a short description/rationale for their entry.

In Delphi process round 1, participants do not yet distinguish between contraindications/red flags and cautions/yellow flags – both are treated the same.

After the planned timeframe for Delphi process round 1 (10 days), the results will be evaluated by the group of facilitators. In-between rounds 1 and 2 of the Delphi process, participants receive the results from the first Delphi process round.

### **Delphi process round 2**

In Delphi process round 2, the synthesized contraindications and cautions are evaluated in a closed question format by the participating experts. Again, each contraindication / caution item is presented with a short description/rationale. Participants will be asked to rate whether they agree that the respective line item is to be considered as contraindication / caution on a 6-point Likert scale (Fig. 2). Participants will be asked to provide a short explanation of their rating. Identical to round 1, in round 2, participants do not yet distinguish between contraindications/red flags and cautions/yellow flags - both are treated the same.

Only contraindications/cautions that at least 75% of participating experts agree with (Likert score 5 or more) in round 2 are further being considered for round 3 of the Delphi process.

Statistical and qualitative results of the second Delphi process round are being sent out to all participants before the start of Delphi process round 3. As in round 2, the analysis will comprise an overall appraisal of all participants' responses.

## **Delphi process round 3**

In round 3, the contraindication / caution deemed relevant in round 2 are reviewed. Each contraindication / caution item is presented with a short description/rationale. Participants are to label each of the relevant contraindications/cautions as either "contraindication/red flag" or "caution/yellow flag" in a closed question format.

Consensus on "contraindications/red flags" will be reached if more than 70% of the participating experts label the respective item as contraindication/red flag. As all other contraindications/cautions have already been considered as highly relevant through the rating process round 2, they will be termed as "caution/yellow flag".

There will be an option to argue against the drop of items in round 2. In an open format text field, experts can outline as to why they would like an item that was dropped in round 2 to be considered as a "contraindication/red flag" or "caution/yellow flag". We assume that participants will only include a line item here, if they fell strongly about it and have a strong line of reasoning. If participants will make use of the arguing option, the facilitator team will review the answers. The respective items will be listed separately, described and discussed in the publication of the study results.

The Delphi process stops after round 3. No further rounds are intended. As in prior rounds, the analysis will comprise an overall appraisal of all participants' responses.

The outputs, planned timeframes, items to be dropped and requirements for consensus of each round are depicted in Fig. 5.

In addition to the consensus process, there will be an opportunity to report specific exemplary cases of suspected health impairments resulting from foam rolling. Following round 3 of the Delphi process, a separate online questionnaire will be distributed among participants and offer the possibility to describe such cases in an anonymous manner.

## **Data processing**

Descriptive statistical analysis will be carried out for the closed question Likert scale evaluations. In round 2, it will be determined for each line item whether or not at least 75% of the participants scored 5 or higher on the 6-point Likert scale. Items that do not fulfil this criterion, will be dropped after Delphi round 1. In round 3, it will be calculated for each line item whether or not 70% of the participating experts label

the respective item as contraindication/red flag. Items that meet this requirement, will be considered as contraindication.

All quantitative statistical analyses will be made with MS Excel (Microsoft Corporation, Redmond, WA, USA).

For the open-ended question in Delphi round 1, a comprehensive list of additional possible contraindications and cautions will be prepared. The list will indicate where recurring themes and items were named by the participants. The analysis will comprise an overall appraisal of all participants' responses.

## **Discussion**

Our study will provide important data to gain an understanding of potential contraindications and cautions of foam rolling. Our findings will provide implications for professionals in sports and physiotherapy: coaches' and therapists' attention will be brought to potential issues and risks of foam rolling.

The collection of exemplary cases of suspected health impairments, resulting from foam rolling, could indicate potential directions and avenues for future studies. Such examples will assist in selecting the scope for future controlled studies and enhance our understanding of the specific risks related to foam rolling.

In terms of practical issues involved in performing the study, we consider the recruitment and retention of participants as crucial. We will take recommended measures to improve panelist recruitment and retention, such as the use of publicly-available information to identify experts, as well as offering social rewards such as publishing panel membership listings. Stressing the practical policy application resulting from our study during the communication process will also aid participants' retention (23).

The study will be performed online without bringing experts together within the same physical space. This has the advantage of bringing experts from different geographical and thematic contexts together while keeping anonymity, it reduces undesired psychological effects among experts, and allows for reflections due to iterative processes and controlled feedback. However, carrying out such a study via online questionnaires also brings along disadvantages: Among others, the limitation of interaction, restriction of the possibility of social reward, as well as possible diverging interpretations of questions and answers have been stated as methodological weaknesses (24) and will have to be considered when discussing results. The language of the study furthermore limits the scope of experts to English speaking participants.

We anticipate that due to the lack of peer-reviewed literature, participants will tend to rate a wide array of answers as relevant contraindications / cautions.

## **Declarations**

### Ethics approval and consent to participate

The present study was approved by the local Ethics Approval Committee of Diploma University of Applied Sciences, Bad Sooden-Allendorf, Germany (approval number EB 1003). All participants will provide informed consent.

### Consent for publication

Not applicable.

### Availability of data and materials

The datasets that will be used and/or analyzed during the current study will be available from the corresponding author on reasonable request.

### Competing interests

RS and KB report funding from the charity association Verein zur Förderung der Faszienforschung e.V. ([www.faszienforschung.de](http://www.faszienforschung.de)). This funding is not related to the current study. JF, CB, JW, GS, MH, WK, ST report no competing interests.

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### Author's contributions

RS and JF conceived of the presented idea. All authors devised the study design, and planned and designed the technical details. KB wrote the manuscript with input from all authors. All authors read and approved the final manuscript.

### Acknowledgements

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## Figures

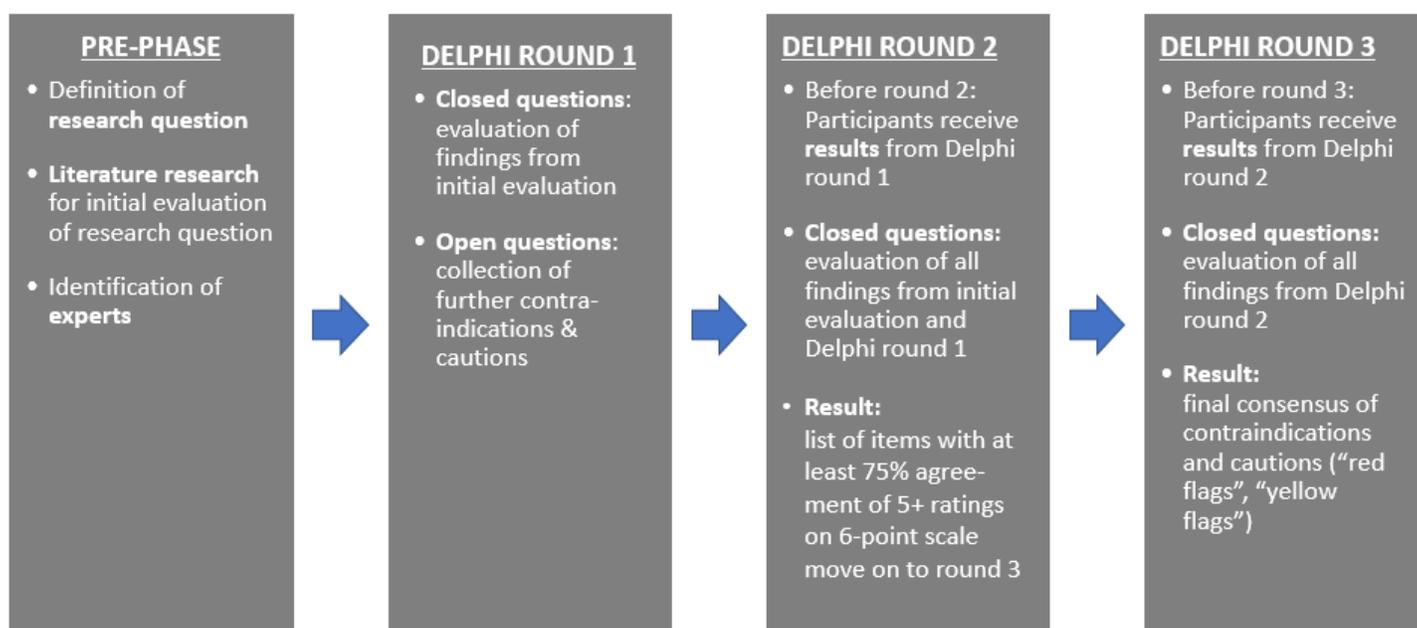


Figure 1

## Anticipated rounds of the Delphi process

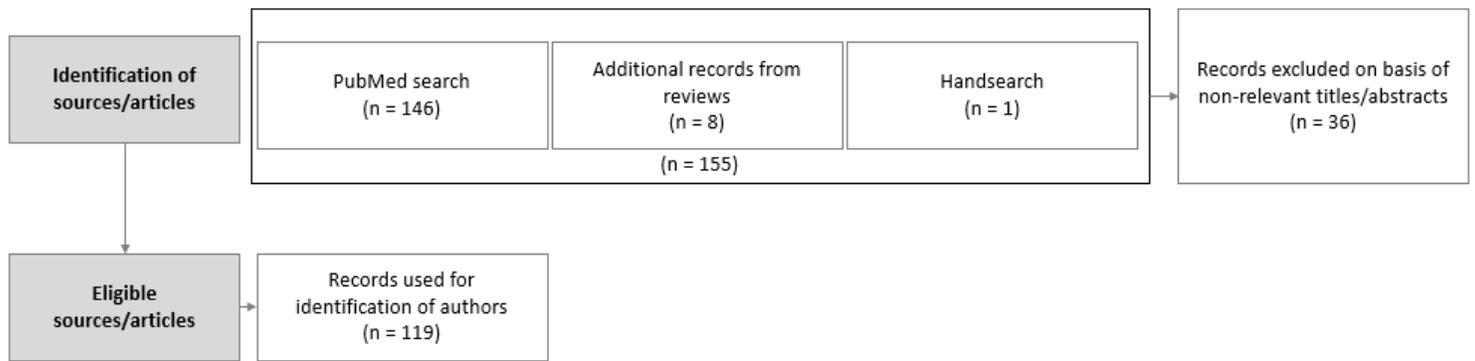
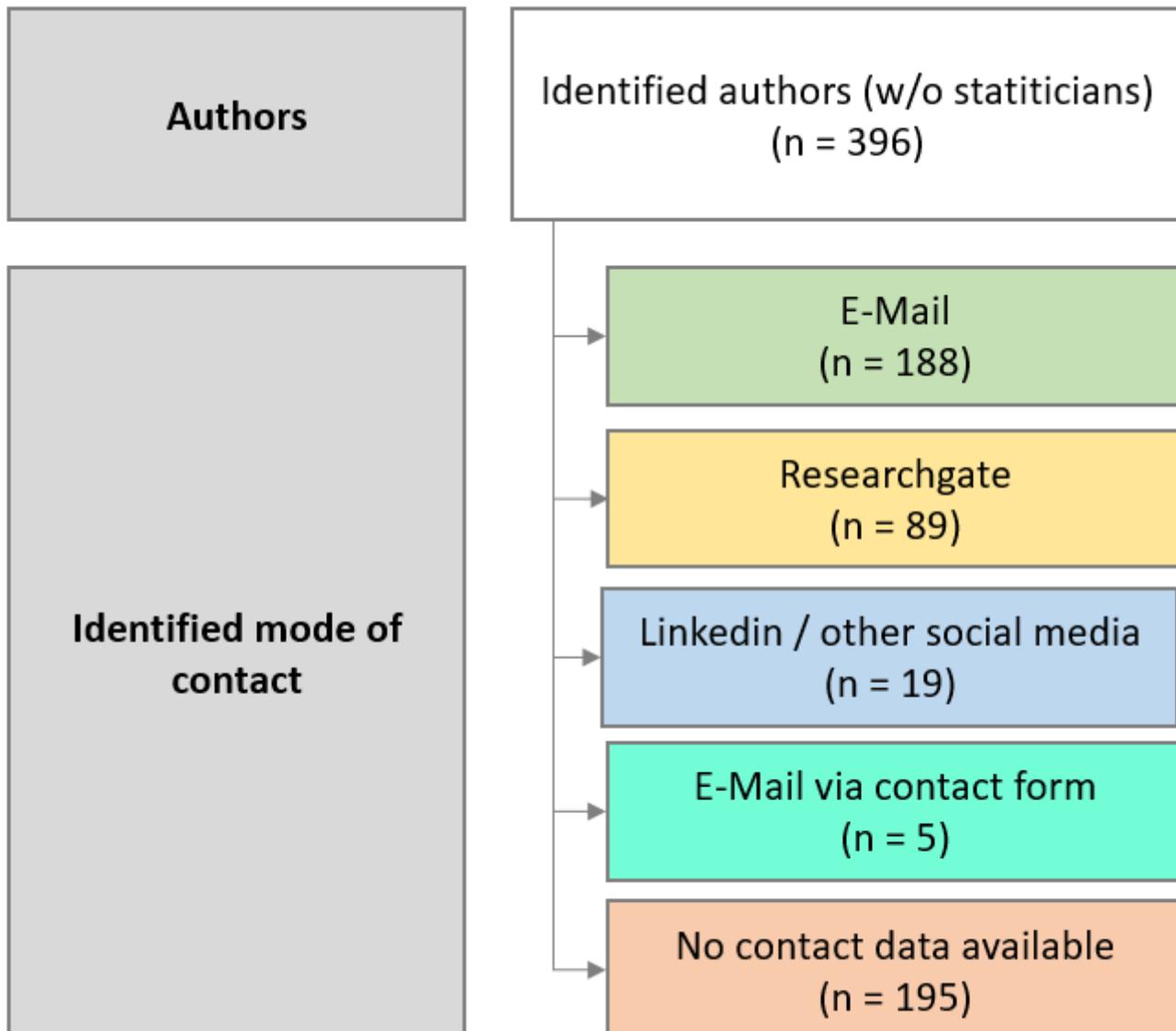


Figure 2

## Overview of selection process for relevant publications



**Figure 3**

Overview of possible authors/academic experts and contact information

1	2	2	4	5	6
Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree

**Figure 4**

6-point Likert scale answer options to assess agreement

	PREPARATORY PHASE	DELPHI ROUND 1	DELPHI ROUND 2	DELPHI ROUND 3
Output	<ul style="list-style-type: none"> <li>Infrastructure/set-up to carry out Delphi exercise</li> <li>List of experts to be included in the Delphi exercise</li> <li>Initial list of possible contraindications / cautions</li> </ul>	<ul style="list-style-type: none"> <li>Comprehensive list of possible contraindications / cautions with reasons</li> <li>First indication of relevance for the contraindications and cautions obtained from the literature</li> </ul>	<ul style="list-style-type: none"> <li>List of contraindications / cautions that experts agree with at least moderately</li> </ul>	<ul style="list-style-type: none"> <li>Final list of "red flags" and "yellow flags"</li> </ul>
Timeframe	<ul style="list-style-type: none"> <li>3 to 4 weeks</li> </ul>	<ul style="list-style-type: none"> <li>Response within 10 days</li> </ul>	<ul style="list-style-type: none"> <li>Response within 10 days</li> </ul>	<ul style="list-style-type: none"> <li>Response within 10 days</li> </ul>
Dropping of items		<ul style="list-style-type: none"> <li>No items will be dropped in round 1</li> </ul>	<ul style="list-style-type: none"> <li>Items that will not be scored 5 or higher on a 6-point Likert scale by at least 75% of the participants will be dropped</li> </ul>	<ul style="list-style-type: none"> <li>No items will be dropped in round 3</li> <li>Veto option for items that were dropped in round 2</li> </ul>
Consensus			<ul style="list-style-type: none"> <li>Only contraindications/ cautions that at least 75% of participating experts agree with at least moderately (Likert score 5 or more) are further being considered for round 3</li> </ul>	<ul style="list-style-type: none"> <li>Consensus on "red flags" will be reached if more than 70% of the participating experts label the respective contraindication / caution as such</li> <li>Other items will be termed as "yellow flags"</li> </ul>

**Figure 5**

Outputs, planned timeframes, items to be dropped and requirements for consensus of each Delphi process round

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Appendix1.xlsx](#)